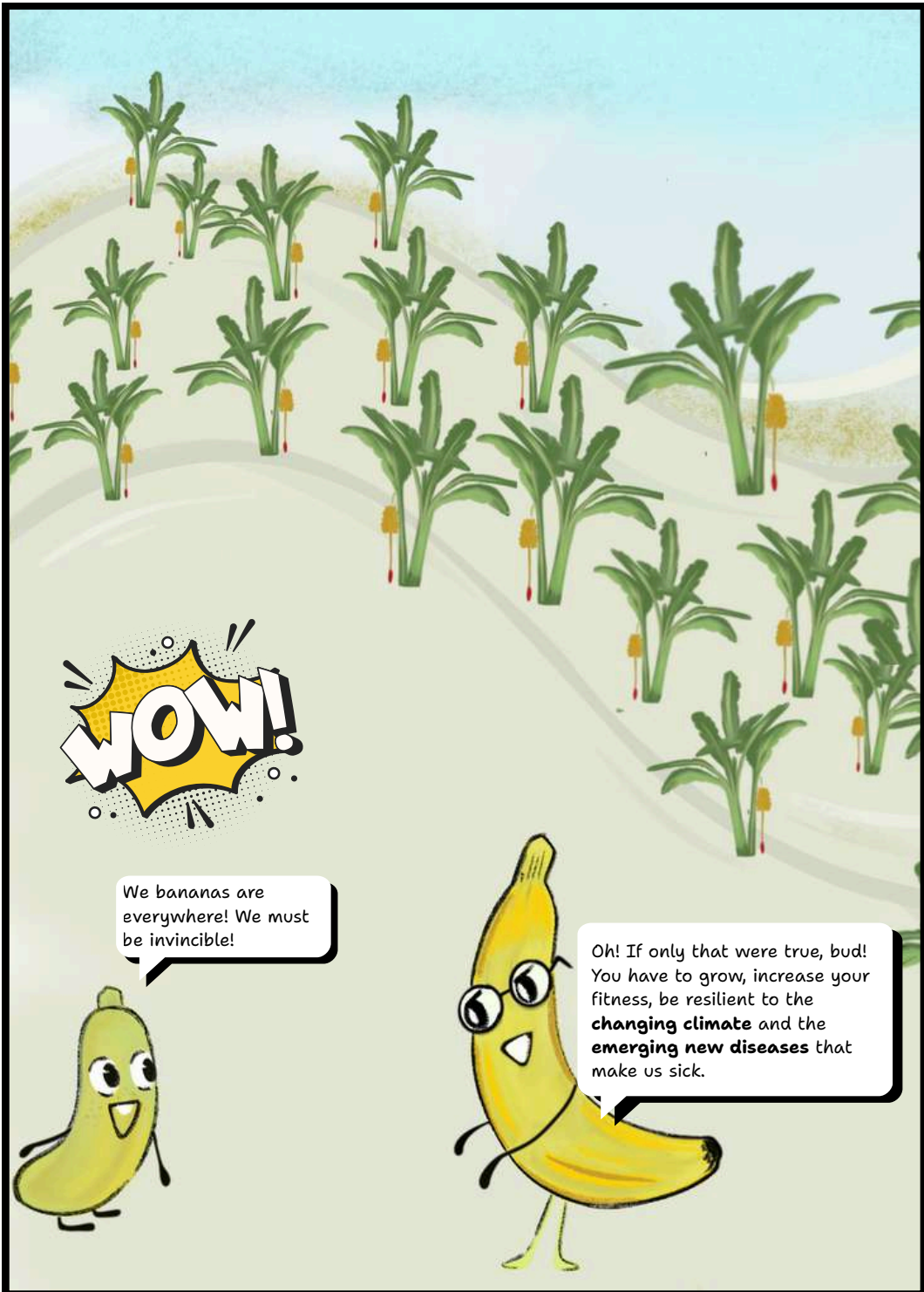


# Fungus Gone **BANANAS**



Rupsy Khurana | Amey Redkar | Vidha Srivastava

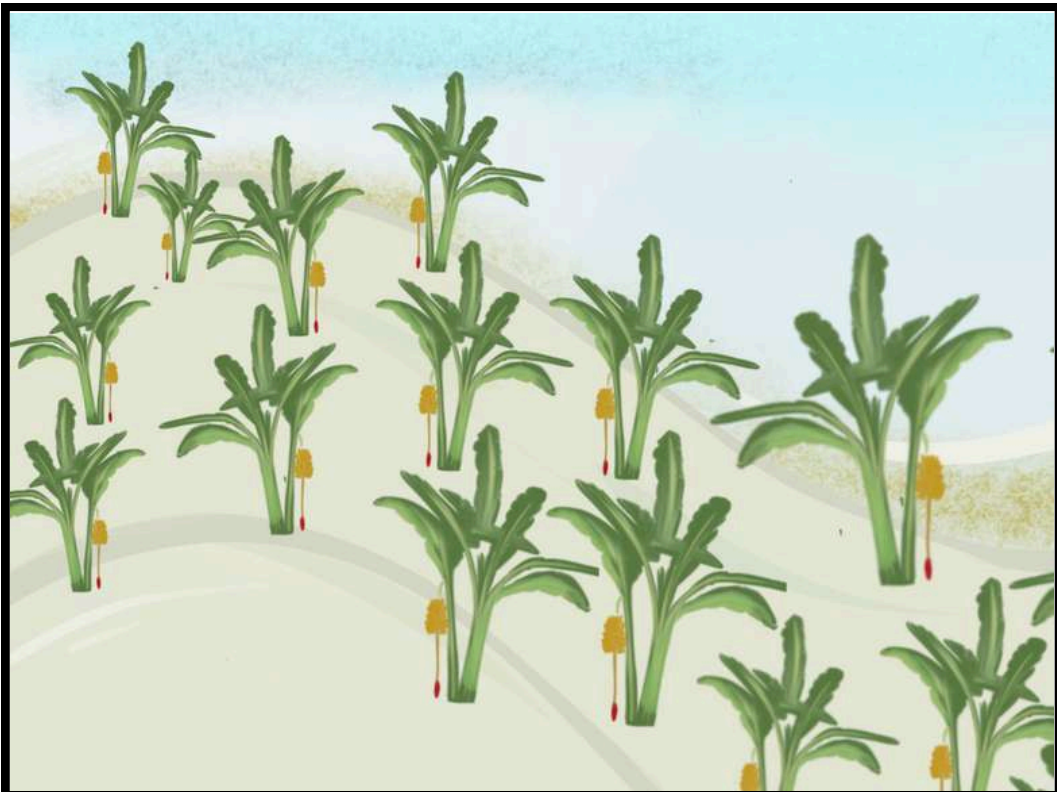
# A SUNNY BANANA PLANTATION



**WOW!**

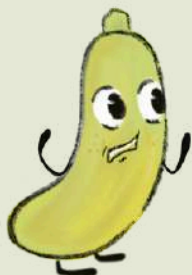
We bananas are everywhere! We must be invincible!

Oh! If only that were true, bud! You have to grow, increase your fitness, be resilient to the **changing climate** and the **emerging new diseases** that make us sick.



Wait... what do you mean? We are in every supermarket, in every home, in every smoothie! We must be winning and already fit to conquer every continent of the world

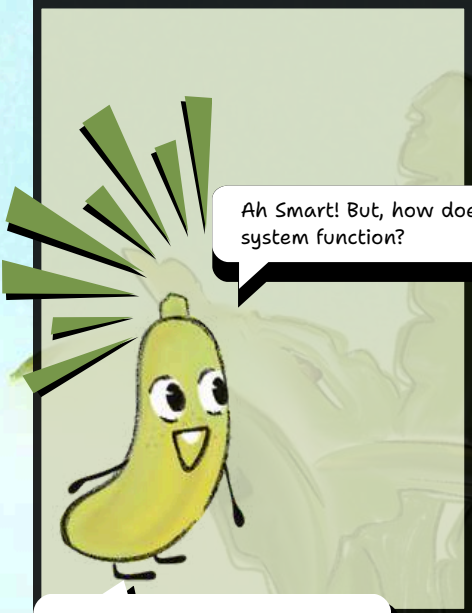
In this scenario of climate change, there is an increasing risk of pathogens that infect us. Unlike humans, we cannot visit a doctor but, we do have a powerful immune system within us.



Does that mean we never get sick?

No, that's not the case. The bugs that infect us have smarter tools. They can pretend to be our friends and even mimic the fitness processes like our bodies- just to trick us!





Ah Smart! But, how does our immune system function?

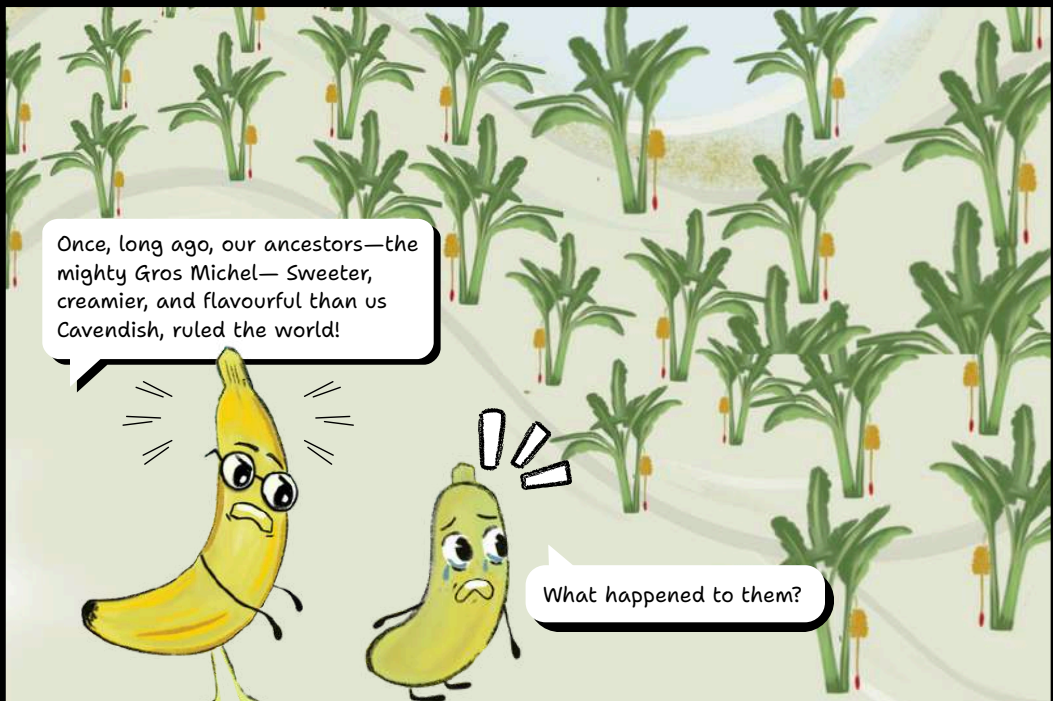
We have components called receptors present on our body surface and also within us. Such surface receptors are our first line of defense. They fight with the enemy to block it before entering us. But, if the enemy invades, then we activate a more robust response to kill the enemy.

But then we are safe, right?


It's a never ending war little one, and it's called an **evolutionary arms race**. Let me tell you a story from the past.....




# INTO THE PAST: HISTORY OF THE MIGHTY GROS MICHEL



Once, long ago, our ancestors—the mighty Gros Michel— Sweeter, creamier, and flavourful than us Cavendish, ruled the world!



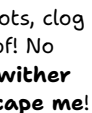
What happened to them?



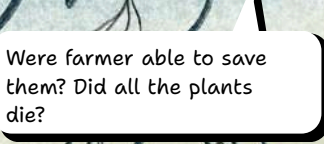
I am scared. That's horrible! How did you manage to survive?



**BANG!**

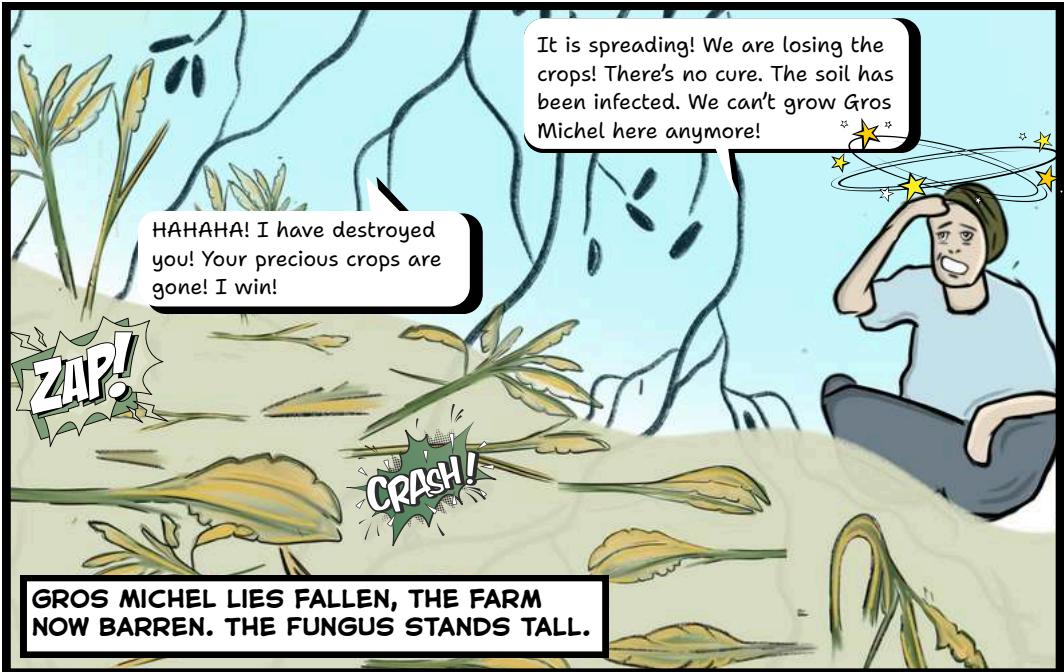


I sneak into your roots, clog your veins, and—poof! No water, no food. **You wither away. You can't escape me!**



Were farmer able to save them? Did all the plants die?

**DARK, CREEPING TENDRILS APPEAR UNDERGROUND—FUSARIUM WILT, ALSO KNOWN AS PANAMA DISEASE. GROS MICHEL STARTS COLLAPSING, THEIR LEAVES TURNING BROWN!**



It is spreading! We are losing the crops! There's no cure. The soil has been infected. We can't grow Gros Michel here anymore!

HAHAHA! I have destroyed you! Your precious crops are gone! I win!

ZAP!

CRASH!

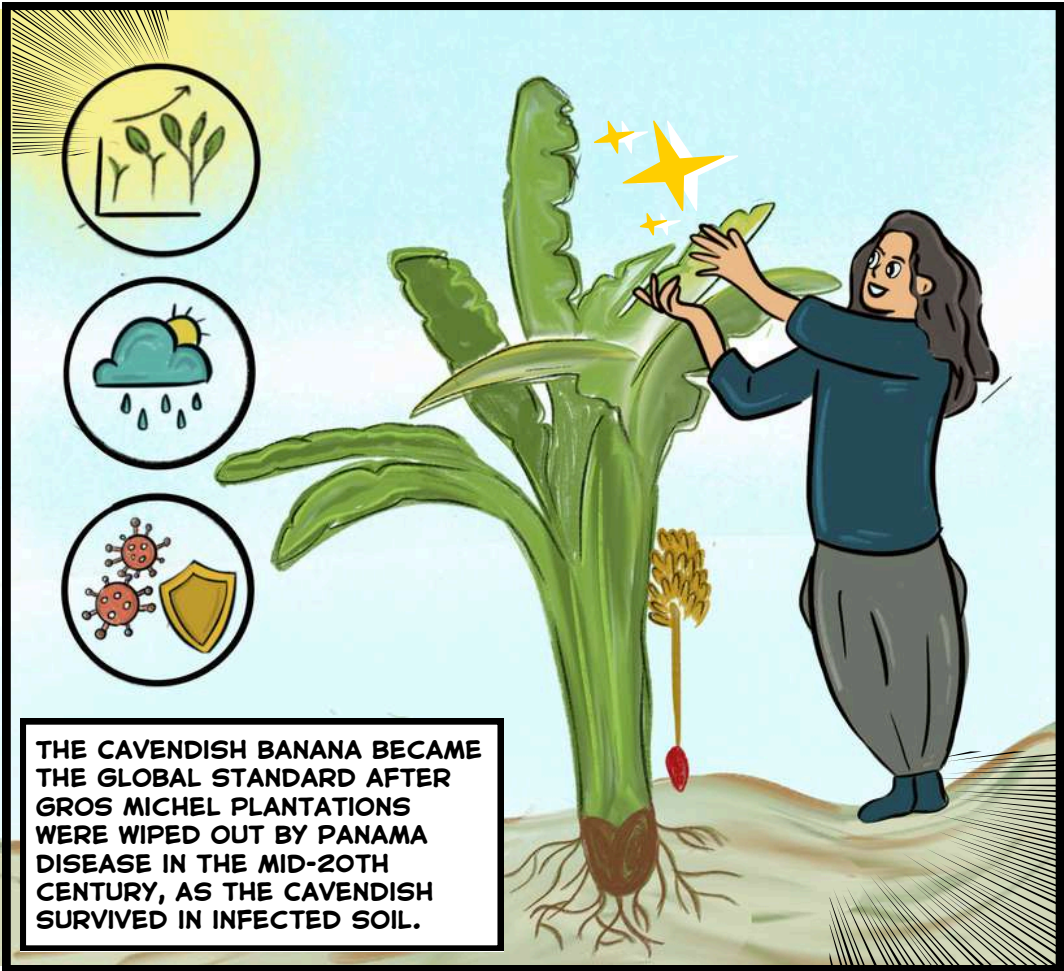
**GROS MICHEL LIES FALLEN, THE FARM NOW BARREN. THE FUNGUS STANDS TALL.**

## FLASH FORWARD - THE RISE OF CAVENDISH!

**IN THE 1800S, A BANANA PLANT WAS SENT FROM MAURITIUS TO ENGLAND AS A GIFT FOR THE DUKE OF DEVONSHIRE. AT THE DUKE'S GARDEN, THIS PLANT WAS NURTURED AND NAMED MUSA CAVENDISHII, IN HIS HONOR.**

**BRITISH TRADERS SPREAD IT TO THE PACIFIC, WEST AFRICA, AND THE CANARY ISLANDS. THOUGH NOT AS FAMOUS AS GROS MICHEL BACK THEN, CAVENDISH WAS GROWING STRONG...**





**THE CAVENDISH BANANA BECAME THE GLOBAL STANDARD AFTER GROS MICHEL PLANTATIONS WERE WIPED OUT BY PANAMA DISEASE IN THE MID-20TH CENTURY, AS THE CAVENDISH SURVIVED IN INFECTED SOIL.**

*We were different, tougher! We took over where Gros Michel fell. We saved the world from a banana-less future.*



*Phew! That was close! But we are safe now, right?*



# FUNGUS APPEARS AGAIN! THIS TIME, BIGGER AND SCARIER!



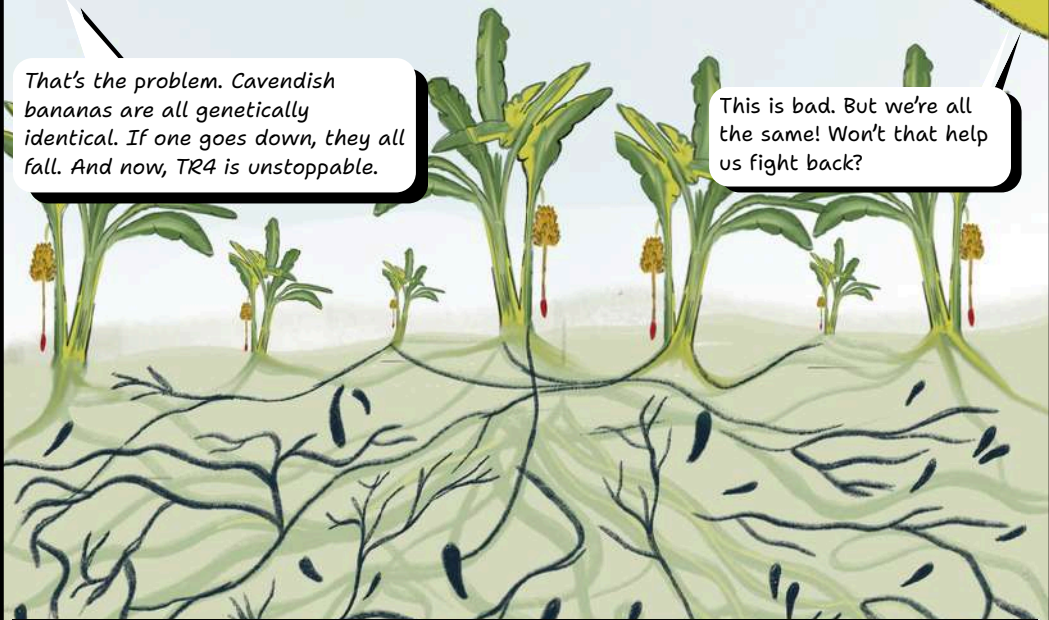
How could this happen again?



TR4 is unstoppable. It started back in the '90s in South East Asia. It's a new, deadlier strain of Panama disease. And it's been evolving ever since. It spreads faster and can survive in the field for longer periods to infect our next generations.

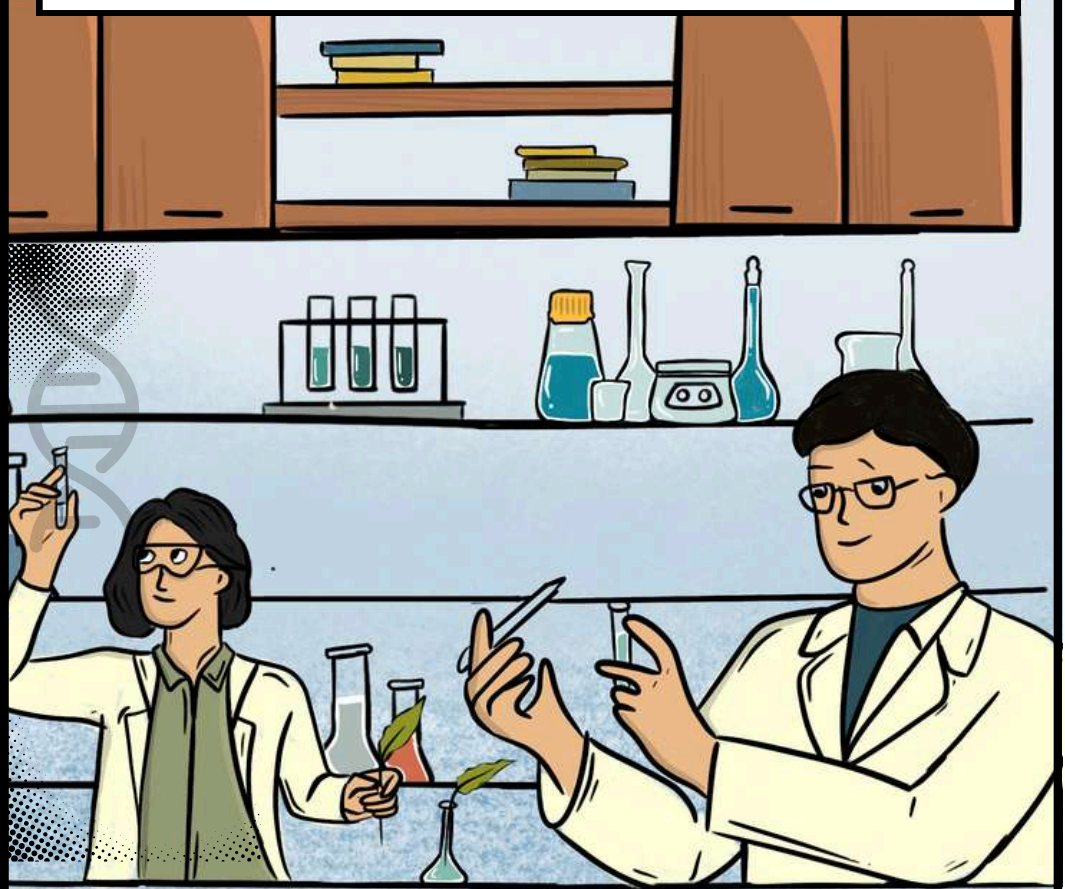
That's the problem. Cavendish bananas are all genetically identical. If one goes down, they all fall. And now, TR4 is unstoppable.

This is bad. But we're all the same! Won't that help us fight back?



**TROPICAL RACE 4 (TR4) SPREADS UNDERGROUND, INFECTING CAVENDISH**

THE DOMESTICATED BANANA VARIETIES SUCH AS THE CAVENDISH AND GROS MICHEL ARE PROPAGATED VEGETATIVELY BY TISSUE CULTURE. THIS METHOD MAKES THEM GENETICALLY IDENTICAL TO EACH OTHER AND PRONE TO PESTS AND DISEASES. WILD SEED-BEARING BANANA VARIETIES HAVE A HUGE GENETIC DIVERSITY THAT CAN RESIST DISEASE.



SCIENTISTS HAVE BEEN EXPLORING THIS GENETIC DIVERSITY IN BANANA TO LOOK FOR GENES THAT CONTRIBUTE TO TR4 RESISTANCE. ONE SUCH EXAMPLE IS AN IDENTIFICATION OF A GENE CALLED RGA2 THAT IS IDENTIFIED FROM A DIPLOID BANANA CULTIVAR AND IS EXPRESSED HIGHER IN CAVENDISH THROUGH PLANT BIOTECHNOLOGY TO CREATE A RESISTANCE VARIETY. IN THE FUTURE, SUCH TECHNOLOGIES CAN HELP TO GENERATE RESISTANT CROPS.

# **AT NCBS, AMEY AND HIS PHD STUDENT, VIDHA, ARE DOING SOME SUPER COOL SCIENCE TO PROTECT PLANTS FROM DISEASES**

In our lab, we study how the fungus and the banana plant talk to each other. The fungus tries to sneak into the roots, and we want to figure out what happens when it does!

Plants have microbiomes- their roots are surrounded by helpful microbes that keep them strong. But the bad ones mess with those helpers.



So, we're trying to find the good helpers—the ones that protect the plant—and make sure the plant has more of them. With the right microbiome, the plant can naturally fight off the bad bugs!

By boosting the plant's own helpers, we can make it stronger and help it fight off the fungus without using harmful chemicals. It's like giving the plant its own built-in team defense squad!

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